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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/214,001	12/24/98	KUDO H	P17380

IM62/0719

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EXAMINER	
VARCOE JR, F	
ART UNIT	**PAPER NUMBER**
1764	9

DATE MAILED: 07/19/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.	Applicant(s)
09/214,001	Kudo et al.
Examiner	**Group Art Unit**
Varcoe	1764

☒ Responsive to communication(s) filed on *Jan 11, 2000*

☐ This action is **FINAL.**

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire *3* month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claim

☒ Claim(s) *1-30* is/are pending in the applicat

Of the above, claim(s) _____ is/are withdrawn from consideration

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) *1-30* is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

Application Papers

☒ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☒ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☒ All ☐ Some* ☒ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) _____ .

☒ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☒ Notice of References Cited, PTO-892

☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). *3, 4 and 8*

☐ Interview Summary, PTO-413

☒ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

— SEE OFFICE ACTION ON THE FOLLOWING PAGES —

DETAILED ACTION

Specification

1. The disclosure is objected to because of the following informalities: The specification contains numerous typographical errors, including "degreasing" in line 21 page 1, and "the three reaction steps ... is...." in line 25 page 1.

The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Appropriate correction is required.

Claim Objections

2. Claim 4 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Claim 4 recites no additional elements except that the reforming reaction unit is concentrically accommodated with the combustion chamber. Claim 3, however, has already recited a reforming reaction unit ... concentrically arranged relative to the combustion unit. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form.

Claims 12-18 and 20-23 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

3. Claim 30 is objected to because of the following informalities: Line 8 contains a typographical error: "degreasing CO."

Appropriate correction is required.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 1-6 and 30 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In line 10 of claim 1, the antecedent of "that" is not clear.

In line 11 of claim 1, there seems to be an introductory word missing. As the claim now stands, the four elements appear to be a raw material reforming unit, a shift reaction unit, an oxidation unit, and at least two units. Perhaps it should read something like "wherein said structure comprises a reforming unit catalyst that is different from the shift reaction catalyst."

In claim 1 line 9, perhaps "degreasing" should read "decreasing the amount of."

With regard to claim 2, line 3 recites "at least said CO oxidation unit." It is not clear what is meant by "at least."

Claim 3 line 3 recites "a reforming reaction unit." Using "a" rather than "said," as well as the words used, indicate this is not the same reforming unit of claim 1. Is this intended? Does claim 3 include both of the two different kinds of reforming unit?

With regard to claim 5, "arranged around" is not clear. Does it mean "partially surrounding?" The new phraseology of claim 1 (in a position outside) seems clearer.

With regard to claim 11, line 2, it is not clear what "respectively" means.

With regard to claim 15, line 4 recites a duct. It is not clear what two regions the duct connects and what flows through the duct.

With regard to claim 18, it is not clear what it means to provide a unit on a surface. Such units are not usually thought of a sitting on surfaces. Also, it is not clear what it is meant by

"with a heat transfer material." It is not clear what is meant by "...of a material composing of said surface." This claim is too unclear to be examined.

With regard to claim 30, "said raw material reforming unit" recited in line 7 lacks clear antecedent basis in the claims.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any

evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

8. Claims 1-11, 19 and 24-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murray et al. EP 0 199 878 A2 in view of Tanizaki JP 07126001 A.

With regard to claim 1, Murray discloses a reforming apparatus comprising a raw material reforming unit (Fig. 2 (58); page 6 line 18), a heat source (Fig. 2 (56); page 6 line 18) that generates heat by combustion of a fuel gas operable to directly heat for the steam reformation reaction from the heat source.

Murray discloses a shift reactor unit (Fig. 2 (60); page 6 line 19).

Murray fails to disclose a CO oxidation unit for further decreasing the amount of CO by oxidation.

Tanizaki discloses a reforming apparatus comprising a reforming and shift reaction region (Fig. 1 (5)), and a CO oxidation unit (Fig. 1 (6)).

Tanizaki and Murray are analogous art in that both deal with reforming hydrocarbons to produce hydrogen.

At the time of the invention it would have been obvious to one skilled in the art to add the CO oxidation unit to the apparatus of Murray.

The motivation would have been to further reduce the concentration of CO in the reformed gas (Tanizaki, English Abstract).

Murray discloses a raw material reforming unit and a shift reaction unit containing different catalysts (reformer made from a nickel compound page 7 lines 2-3, shift catalyst made from a chromium material page 7 lines 14-15).

Murray discloses the shift reaction unit arranged (Fig. 2) so as to be indirectly heated by heat transfer from the heat source of the raw material reforming unit.

Tanizaki discloses the CO oxidation unit arranged (Fig. 1) so as to be indirectly heated by heat transfer from the heat source of the raw material reforming unit.

Tanizaki discloses the CO oxidation unit arranged in a position outside the raw material unit (Fig. 1)

Thus it would have been obvious to combine the CO oxidation unit with the apparatus of Murray to get the invention of claim 1.

With regard to claim 2, Murray discloses the raw material reforming unit and the shift reaction unit arranged concentrically (Fig. 2).

Tanizaki discloses the CO oxidation unit placed on an outer peripheral side of the reforming apparatus (Fig. 1).

Neither Murray nor Tanizaki discloses the CO unit arranged concentrically with the reforming unit. Given that Murray discloses the shift reactor arranged concentrically with the reactor unit, it would have been obvious to arrange the CO oxidation unit the same way.

The motivation would have been to improve fuel processing efficiency as well as thermal and spatial efficiency using the same size reformer (Murray page 6 lines 8-15).

Thus it would have been obvious to alter the modified apparatus of Murray to get the invention of claim 2.

With regard to claim 3, Murray discloses a reforming apparatus wherein the raw material reforming unit comprises a generally cylindrical combustion chamber as the heat source (Fig. 2).

With regard to claim 4, Murray discloses the reforming reaction unit concentrically accommodated with the combustion chamber (Fig. 2).

With regard to claim 5, Murray discloses a reforming reaction unit arranged around the combustion chamber and in contact therewith (Fig. 2).

With regard to claim 6, Murray discloses an incombustible core arranged at the center of the combustion chamber (Fig. 2). That incombustible core is composed of catalyst particles.

With regard to claim 7, the modified apparatus of Murray discloses a shift reaction unit arranged around the reforming reaction unit. While the location of the CO oxidation unit is not disclosed, it would have been obvious to place it around the reforming reaction unit.

Given that Murray discloses the shift reactor arranged around the reactor unit, it would have been obvious to arrange the CO oxidation unit the same way.

The motivation would have been to improve fuel processing efficiency as well as thermal and spatial efficiency using the same size reformer (Murray page 6 lines 8-15).

Thus it would have been obvious to alter the modified apparatus of Murray to get the invention of claim 7.

With regard to claim 8, the modified apparatus of Murray contains a partition wall (Fig. 2 (78); page 7 line 14) interposed between the reforming unit (58) and the shift reaction unit (60).

The modified apparatus of Murray does not specify that there be a partition between the CO oxidation unit and the reforming unit, but lacking any partition, the contents of the units would mix, interfering with their separate functions. Any partition present for separating the units would also function as a heat transfer regulator.

With regard to claim 9, Murray discloses a flow path connecting the reforming reaction unit and the shift reaction unit that detours outside of both the shift reaction unit and the CO oxidation unit (Fig. 2 (86); page 7 lines 11-12).

With regard to claim 10, Tanizaki discloses a shift reaction unit arranged on a side adjacent to a high temperature zone of the reaction unit (Fig. 1 (5)). These two zones are together. The CO oxidation unit (Fig. 1 (6)) is above those two zones in a cooler region of the apparatus.

With regard to claim 11, Murray discloses a shift reaction unit heated by burned exhaust gas form the heat source of the raw material reforming unit (Fig. 1). Some of that heat arrives indirectly. Although Murray does not mention a CO oxidation unit, treating the CO unit of the modified apparatus of Murray the same as the shift reactor is discussed in the rejection of claim 2 above.

With regard to claim 19, since placing fins for heat dissipation on objects is well-known in the art. it would have been obvious to place cooling fins on the CO oxidation unit.

With regard to claim 24, Murray discloses apparatus wherein a portion of the raw material feed channel is arranged so that the raw material is heated by heat form the heat source. That heating happens just after the raw material passes beyond the opening (94) downstream form the preheater (93).

With regard to claim 25, Murray discloses a portion of the raw material feed channel in contact with the reforming unit. This is the portion at the entrance to the reforming unit (Fig. 2).

With regard to claim 26, Murray discloses a reforming apparatus wherein a portion of the raw material feed channel contacts the burned exhaust gas from the heat source (Fig. 2).

With regard to claim 27, Murray discloses a raw material feed channel directly heated by the heat source of the raw material reforming unit (Fig. 2).

With regard to claim 28, Murray discloses a fuel feed channel arranged so as to be able to be preheated by heat form the heat source of the req material reforming unit (Fig. 2). That preheating takes place in mixing chamber (64).

With regard to claim 29, Murray discloses a combustion catalyst held in the heat source, wherein the heat source generates heat by catalytic combustion (Fig. 2). Murray also discloses a means for preheating the combustion catalyst, namely the heated spent anode gas from the fuel cell page 7 lines 19-23. In addition, it would have been obvious to use a preheater such as that used in the raw material inlet line (93). The motivation would have been to preheat the combustion catalyst up to a temperature sufficiently high for combustion.

With regard to claim 30, Murray discloses a reforming apparatus comprising a combustion unit (Fig. 2 (56); page 6 line 18).

Murray discloses a reforming unit (Fig. 2 (58); page 6 line 18).

Murray discloses a shift reactor unit (Fig. 2 (60); page 6 line 19).

Murray fails to disclose a CO oxidation unit for further decreasing the amount of CO by oxidation.

Tanizaki discloses a reforming apparatus comprising a reforming and shift reaction region (Fig. 1 (5)), and a CO oxidation unit (Fig. 1 (6)).

Tanizaki discloses the CO oxidation unit arranged (Fig. 1) so as to be indirectly heated by heat transfer from the combustion unit (Fig 1).

Tanizaki and Murray are analogous art in that both deal with reforming hydrocarbons to produce hydrogen.

At the time of the invention it would have been obvious to one skilled in the art to add the CO oxidation unit to the apparatus of Murray.

The motivation would have been to further reduce the concentration of CO in the reformed gas (Tanizaki, English Abstract).

Murray discloses the shift reaction unit arranged (Fig. 2) so as to be indirectly heated by heat transfer from the heat source of the raw material reforming unit.

Murray discloses a reforming unit directly heated by the combustion unit (Fig. 2).

Murray discloses a shift reaction unit indirectly heated by heat transfer from the combustion unit (Fig. 2).

The temperatures at which the parts of the apparatus are operated are intended uses only and not patentable subject matter in an apparatus claim.

Thus it would have been obvious to combine the CO oxidation unit with the apparatus of Murray to get the invention of claim 30.

Allowable Subject Matter

9. Claims 12-17 and 20-23 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

10. The following is a statement of reasons for the indication of allowable subject matter:

Claim 12 recites a shift reactor arranged so as to be concentric with (i.e. coaxial with) a cylindrical combustion chamber. In addition, the claim recites a CO oxidation unit arranged so as to be concentric with (i.e. coaxial with) the combustion chamber, and located around the shift reactor. The prior does not disclose or fairly suggest a CO oxidation reactor arranged around and coaxial with a shift reactor.

Claims 13-17 are allowable because they depend from claim 12.

Claim 20 recites a shift reactor arranged so as to be concentric with (i.e. coaxial with) a cylindrical combustion chamber. In addition, the claim recites a CO oxidation unit arranged so as to be concentric with (i.e. coaxial with) the combustion chamber. Further the claim recites the shift reactor and the CO oxidation unit placed in ducts located around the main exhaust chamber. The prior art does not disclose or fairly teach placing the shift reactor and the CO oxidation reactor inside ducts and arranging the ducts around a main oxidation chamber.

Claims 21-13 are allowable because they depend from claim 20.

Conclusion

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rick Varcoe, whose telephone number is (703) 306-5477. The examiner can normally be reached Monday through Friday from 9:00 am to 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Marian Knode, can be reached on (703) 308-4311.

The FAX telephone number for this Group Art Unit is (703) 305-3599 (for Official papers after Final), (703) 305-5408 (for other Official papers) and (703) 305-6357 (for Unofficial papers).

When filing a FAX in Group 1700, please indicate in the Header (upper right) "Official" for papers that are to be entered into the file, and "Unofficial" for draft documents and other communications with the PTO that are not for entry into the file of the application. This will expedite processing your papers.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308-0661.

RV
July 14, 2000

Marian C. Knode
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